

**Core Research Activity:**

Division:

Primary Contact(s):

Division Director:

**Experimental Program to Stimulate Competitive Research**

Materials Sciences and Engineering

Matesh N. Varma ([matesh.varma@science.doe.gov](mailto:matesh.varma@science.doe.gov); 301-903-3209)

Iran L. Thomas

**Portfolio Description:**

Basic research spanning the entire range of programmatic activities supported by the Office of Science in states that have historically received relatively less Federal research funding. The DOE designated EPSCoR states are Alabama, Alaska, Arkansas, Hawaii, Idaho, Kansas, Kentucky, Louisiana, Maine, Mississippi, Montana, Nebraska, Nevada, New Mexico, North Dakota, Oklahoma, South Carolina, South Dakota, Vermont, West Virginia, and Wyoming, and the Commonwealth of Puerto Rico. BES manages EPSCoR for the Department.

**Unique Aspects:**

The program objective is accomplished by sponsoring two types of grants: 1) Implementation Grants, and 2) Laboratory-State partnership Grants. Implementation grants are for a maximum period of six years with an initial grant period of three years. Maximum funding for these grants is \$750,000 per year. One-to-one state matching funds are required. The Laboratory-State partnership grants are for a period of one to three years. Maximum funding for these grants is \$150,000 per year. Exactly 10% state matching funds are required. DOE/EPSCoR has placed a high priority on integrating the scientific manpower development component with the research component of the program. In addition, it is promoting strong research collaboration and training of students at the DOE national laboratories where unique and world-class facilities are supported by the Department. This program is science-driven and supports the most meritorious proposals based on peer and merit review. Workshops and discussions are regularly held with representative scientists from EPSCoR states to acquaint them with the facilities and personnel at the DOE laboratories.

**Relationship to Others:**

The core activity interfaces with all other program core activities within the Office of Basic Energy Sciences. In addition, it is responsive to programmatic needs of other program offices within the department.

**Significant Accomplishments:**

The EPSCoR program funds basic research in support of all programmatic needs of the department. The accomplishments are grouped according to the relevant DOE programmatic office.

- **Basic Energy Sciences:** Direct evidence was demonstrated for the importance of magnetostatic interactions in characterizing novel nanostructured materials. Inclusion of such interactions in the study of new and novel materials should lead to better characterization of these materials. The Interfacial Force Microscope has been used to obtain the elastic modulus for several polymer and polymer matrix composite systems with nanometer spatial resolution. These results reveal surface modulus inhomogeneities in polymers and systematic variations in modulus in the interphase of polymer matrix composites. These studies are important for developing novel lightweight polymer matrix composites. Kirkwood-Buff theory has been successfully applied for the interpretation of thermodynamic solvation effects in terms of the distribution of water and salts around benzene. This successful demonstration holds promise for application to a wide range of research studies using molecular dynamics simulations. Purification of single-walled, shortened, carbon nanotubes by capillary electrophoresis was demonstrated by using UV/visible and real-time Raman spectroscopy. This should pave the way for isolating different sizes of carbon nanotubes.
- **Biological and Environmental Research:** Significant progress is being made in crystallizing and solving the structure of the engrailed homeodomain Q50K mutant for use in developing a novel methodology for pharmaceutical design targeting DNA expression.
- **Environmental Management:** Enzyme-activity dependent probes and inhibitors were used to characterize bacterial isolates from the trichloroethylene (TCE) contaminated site at INEEL. These probes will be very useful in environmental management issues at the DOE sites. Developed unique magnetorestriction based sensor technology for measuring temperature, elasticity, pressure, pH, liquid viscosity, and liquid density. This technology will be very useful for application to environmental cleanup and environmental management issues.

- **Renewable Energy and Efficiency:** A first commercial wind power facility, a 22MW wind turbine utility is being established on the Blackfeet nation's land. This facility is based on the research supported by EPSCoR. A new technology "Resin Transfer Molding" is developed and its application to manufacture of wind turbine blades was demonstrated.
- **Defense Programs:** Optical sensors based on Faraday rotation were developed for monitoring electric and magnetic fields. These sensors are being developed for use in improved operation of the electron beam accelerators and imaging systems that are used in DOE stockpile stewardship program.

#### **Mission Relevance:**

The principal objective of the DOE/EPSCoR program is to enhance the abilities of the designated states to conduct nationally competitive energy-related research and to develop science and engineering manpower to meet current and future needs in energy related areas. Most of the research clusters that have graduated from the DOE EPSCoR program after six years of funding have found alternate funding for continuing the research activity. This demonstrates that the research clusters funded by EPSCoR are becoming competitive. In addition, EPSCoR grants are supporting graduate students, undergraduates and postdoctoral fellows, and encouraging them to be trained in world-class research at DOE national laboratories. The work supported by the EPSCoR program impacts all DOE mission areas including research in materials science, chemical science, biological and environmental science, high energy and nuclear physics, fusion energy science, advanced computer science, fossil energy science, and energy efficiency and renewable energy science.

#### **Scientific Challenges:**

Initially only nine states were awarded implantation awards, which left many of the designated states without any DOE EPSCoR funding. To accommodate participation from a larger number of states in the program and to leverage the state-of-the-art unique capabilities of the national laboratories, a State-Laboratory partnership program was initiated in FY98. As a result of this program, approximately 28 partnership awards were approved in FY98 and FY99. In FY00 and FY01 twenty additional State-Laboratory partnership awards were funded in response to solicitation number 99-21. In FY00 another solicitation was issued and in response to this solicitation twelve State-Laboratory partnership awards were made in FY01, and it is planned to award an additional ten in FY02. This component of the program has successfully increased the number of states receiving funds from DOE EPSCoR program. The program continues to meet the challenge of providing a balance between the implementation awards and the Laboratory-State partnership awards.

#### **Funding Summary:**

##### **Dollars in Thousands**

	<u>FY 2000</u>	<u>FY 2001</u>	<u>FY 2002</u>
<b>Total</b>	<b>6,815,000</b>	<b>7,685,000</b>	<b>7,685,000</b>
Alabama	225,000	399,877	814,078
Alaska	0	0	0
Arkansas	100,000	65,000	205,000
Hawaii**	0	0	0
Idaho	162,000	106,508	0
Kansas	749,000	932,279	801,713
Kentucky	560,000	468,160	611,252
Louisiana	151,000	129,577	130,138
Maine	0	0	0
Mississippi	585,000	585,000	535,000
Montana	125,000	514,279	579,734
Nebraska	300,000	480,150	472,113

New Mexico**	0	0	0
Nevada	421,000	614,907	542,466
North Dakota	46,000	67,246	54,242
Oklahoma	100,000	164,995	204,146
Puerto Rico	50,000	450,000	435,000
South Carolina	855,000	1,201,054	558,368
South Dakota	50,000	0	0
Vermont	585,000	585,000	857,457
West Virginia	568,000	794,163	793,865
Wyoming	851,000	59,301	30,537
Technical Support	332,000	67,504	59,891

\*\* Becomes eligible for funding in FY 2002

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SBIR	185,000*	315,000*	315,000*
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04 February 2002